

What is Claimed is:

1. A radiation-shielded X-ray module comprising:

an X-ray tube that emits X-rays;

5 a high voltage power supply coupled to said X-ray tube that supplies a high voltage for use with said X-ray tube; and

electrical connection that connects the X-ray tube to the high voltage power supply, wherein the X-ray tube, the high voltage power supply and the electrical connection are encapsulated in a solid, electrically-insulating material containing a radio-
10 opaque material, said radio-opaque material including a material selected from the group consisting of tungsten, lead, calcium, tantalum, tin, molybdenum, copper, strontium, aluminum, bismuth, and compounds and mixtures containing any of the above materials.

2. The radiation-shielded X-ray module of Claim 1, further comprising:

15 a resonant converter that drives said high voltage power supply.

3. The radiation-shielded X-ray module of Claim 2, further comprising:

a step up transformer connected to said resonant converter; and

a high-voltage multiplier driven by said step up transformer.

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4. The radiation-shielded X-ray module of Claim 1, wherein an amount of said radio-opaque material is selected in accordance with a predetermined degree of radiation attenuation.

5. The radiation-shielded X-ray module of Claim 1, further comprising:
a thin conductive layer over said solid, electrically insulating material to provide electric shielding.

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6. The radiation-shielded X-ray module of Claim 5, wherein said thin conductive layer is formed from one of: a conductive metallic paint, a thin metal foil, and a metallized polymer.

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7. The radiation-shielded X-ray module of Claim 6, wherein said thin conductive layer is formed from a thin metal foil made from at least one of: copper and aluminum.

8. The radiation-shielded X-ray module of Claim 7, wherein said thin metal foil is adhered directly to said solid, electrically insulating material using an adhesive.

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9. The radiation-shielded X-ray module of Claim 1, wherein the solid, electrically-insulating material is molded into a complex shape.

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10. The radiation-shielded X-ray module of Claim 1, wherein the X-ray tube and the high-voltage power supply are connected by a coaxial cable.

11. The radiation-shielded X-ray module of Claim 1, wherein the radiation-shielded X-ray module is included in a portable X-ray instrument.

12. An X-ray module comprising

an X-ray tube,

a resonant converter,

a high voltage power supply driven by the resonant converter,

5 electrical connection that connects the X-ray tube to the high voltage power
supply and connects the high voltage power supply to the resonant converter, wherein the
X-ray tube, high voltage power supply and electrical connection connecting the X-ray
tube to the high voltage power supply are encapsulated in a solid, electrically-insulating
material, said electrically-insulating material including a radio-opaque material selected from the
10 group consisting of tungsten, lead, calcium, tantalum, tin, molybdenum, copper, strontium,
aluminum, bismuth, and compounds and mixtures containing any of the above materials.

13. The X-ray module of Claim 12, wherein said solid, electrically insulating
material comprises at least one of: epoxy, urethane, and silicon potting compound.

15 14. The X-ray module of Claim 12, further comprising:
a thin conductive layer over said solid, electrically insulating material to provide
electric shielding.

20 15. The X-ray module of Claim 14, wherein said thin conductive layer is formed
from one of: a conductive metallic paint, a thin metal foil, and a metallized polymer.

16. The X-ray module of Claim 15, wherein said thin conductive layer is formed
from a thin metal foil made from at least one of: copper and aluminum.

17. The X-ray module of Claim 16, wherein said thin metal foil is adhered directly to said solid, electrically insulating material using an adhesive.

5 18. The X-ray module of Claim 12, wherein the solid, electrically-insulating material is molded into a complex shape.

19. The X-ray module of Claim 12, wherein the X-ray tube and the high-voltage power supply are connected by a coaxial cable.

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20. The X-ray module of Claim 12, wherein the X-ray module is included in a portable X-ray instrument.

21. A method of producing an X-ray module comprising:

15 encapsulating electronic components used in X-ray emission in a solid cast block including a radio-opaque material, said radio-opaque material including a material selected from the group consisting of tungsten, lead, calcium, tantalum, tin, molybdenum, copper, strontium, aluminum, bismuth, and compounds and mixtures containing any of the above materials; and

20 surrounding said solid cast block by a conductive layer.

22. The method of Claim 21, wherein said solid cast block comprises at least one of epoxy, urethane, and a silicon potting compound.

23. The method of Claim 21, further comprising:
encapsulating power and control circuit components in a solid cast block
including a radio-opaque material.

5 24. The method of Claim 21, further comprising:
casting said solid cast block using a two-part epoxy-resin casting system.

25. The method of Claim 21, wherein an amount of said radio-opaque material is
in accordance with a predetermined degree of radiation attenuation.

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26. The method of Claim 21, wherein said conductive layer is formed from one
of: a conductive metallic paint, a thin metal foil, and a metallized polymer.

27. The method of Claim 26, wherein said conductive layer is formed from a
15 thin metal foil made from at least one of: copper and aluminum.

28. The method of Claim 27, further comprising:
adhering said thin metal foil directly to said solid, electrically insulating material
using an adhesive.

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29. The method of Claim 21, wherein the X-ray module is included in a portable
X-ray instrument.

30. A radiation-shielded X-ray module comprising:
an X-ray tube that emits X-rays;
a high voltage power supply coupled to said X-ray tube that supplies a high
voltage for use with said X-ray tube; and

5 electrical connection that connects the X-ray tube to the high voltage power
supply, wherein the X-ray tube is encapsulated in a solid, electrically-insulating material
containing a radio-opaque material, said radio-opaque material including a material
selected from the group consisting of tungsten, lead, calcium, tantalum, tin, molybdenum,
copper, strontium, aluminum, bismuth, and compounds and mixtures containing any of
10 the above materials.

31. The radiation shielded X-ray module of Claim 30, wherein the radiation-
shielded X-ray module is included in a portable X-ray instrument.

15 32. The radiation-shielded X-ray module of Claim 30, further comprising:
a resonant converter that drives said high voltage power supply.

33. The radiation-shielded X-ray module of Claim 30, further comprising:
a step up transformer connected to said resonant converter; and
20 a high-voltage multiplier driven by said step up transformer.

34. The radiation-shielded X-ray module of Claim 30, wherein an amount of said radio-opaque material is in accordance with a predetermined degree of radiation attenuation.

5 35. The radiation-shielded X-ray module of Claim 30, further comprising:
a thin conductive layer over said solid, electrically insulating material to provide electrical shielding.

36. The radiation-shielded X-ray module of Claim 35, wherein said thin
10 conductive layer is formed from one of: a conductive metallic paint, a thin metal foil, and a metallized polymer.

37. The radiation-shielded X-ray module of Claim 36, wherein said thin
conductive layer is formed from a thin metal foil made from at least one of: copper and
15 aluminum.

38. The radiation-shielded X-ray module of Claim 37, wherein said thin metal
foil is adhered directly to said solid, electrically insulating material using an adhesive.

20 39. The radiation-shielded X-ray module of Claim 30, wherein the solid,
electrically-insulating material is molded into a complex shape.

40. The radiation-shielded X-ray module of Claim 30, wherein the X-ray tube and the high-voltage power supply are connected by a coaxial cable.

41. The radiation-shielded X-ray module of Claim 1, wherein the radio-opaque material
5 comprises an oxide of tungsten, lead, or bismuth.